Amendments to the Specification

Please replace the 5 paragraphs beginning on page 4, line 1 with the following amended paragraphs:

FIG. 9 is a drawing to explain ~~for explaining~~ other embodiments of the presented invention.

FIG. 10 is a drawing to explain ~~for explaining~~ further embodiments of the present invention.

FIG. 11 is a drawing to explain ~~for explaining~~ further embodiments of the present invention.

FIG. 12 is a drawing to explain ~~for explaining~~ further embodiments of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Conventional filtering processes consider a single reconstructed image frame at a time. Block based video encoding techniques may use motion vectors to estimate the movement of blocks consisting of a plurality of pixels. The motion-vector information is available at both the encoder and decoder but is not used with conventional filtering processes. For example, if two adjacent blocks share the same motion vector with respect to the same reference image frame, (for a multiple reference frames system) there is likely no significant difference between the image residuals of each block and accordingly should not be filtered. In essence, adjacent portions of the image have the same motion with respect to the same reference frame and accordingly no significant difference between the image residuals would be expected. In many cases, the block boundary of these two adjacent blocks may have been filtered in the reference

frame and should therefore not be filtered again for the current frame. If a deblock filter is used without considering this motion-vector information, the conventional filtering process might filter the same boundary again and again from frame to frame. This unnecessary filtering not only causes unnecessary blurring but also results in additional filter computations.

Please replace the paragraph beginning on page 7, line 8 with the following:

FIG. 3 illustrates another example of a coding parameter that may be used to decide whether or not to selectively skip deblock filtering. The image block 44 from image frame 40 is compared with reference block 44' from the reference frame 42 pointed to by the motion vector MV1 as previously illustrated in FIG. 2. A residual block 44" is output from the comparison between image block 44 and reference block 44'. A transform 50 is performed on the residual block 44" creating a transformed block ~~44"~~ 44 of transform coefficients. In one example, the transform 50 is a Discrete Cosine Transform. The transformed block ~~44"~~ 44 includes ~~a~~ D.C. components 52 and A.C. components 53.

Please replace the paragraph beginning on page 8, line 1 with the following:

FIG. 4 illustrates the transformed residual blocks ~~44"~~ 44 and ~~46"~~ 46. The D.C. components 52 from the two transformed blocks ~~44"~~ 44 and ~~46"~~ 46 are compared in processor 54. If the D.C. components are the same or within some range of each other, the processor 54 notifies a deblock filter operation 56 to skip deblock filtering between the border of the two adjacent blocks 44 and 46. If the D.C. components 52 are not similar, then no skip notification is initiated and the border between blocks 44 and 46 is deblock filtered.

Please replace the paragraph beginning on page 8, line 7 with the following:

In one example, the skip mode filtering may be incorporated into the Telecommunications Sector of the International Telecommunication Union (ITU-T) proposed H.26L encoding scheme. The H.26L scheme uses 4x4 integer Discrete Cosine Transform (DCT) blocks. If desired, only the D.C. component of the two adjacent blocks may be checked. However some limited low frequency A.C. coefficients may likewise be checked, especially when the image blocks are larger sizes, such as 9x9 or 16x16 blocks. For example, the upper D.C. component 52 and the three lower frequency A.C. transform coefficients 53 for block ~~44"~~ 44 maybe compared with the upper D.C. component 52 and three lower frequency A.C. transform coefficients 53 for block ~~46"~~ 46 . Different combinations of D.C. and/or any of the A.C. transform coefficients can be used to identify the relative similarity between the two adjacent blocks 44 and 46.

Please replace the paragraph beginning on page 9, line 13 with the following:

The encoding section of the codec 60 reconstructs the transformed ~~and quantized~~ image by first Inverse Quantizing (IQ) the transformed and quantized image in box 72. The inverse quantized image is then inverse transformed in box 74 to generate a reconstructed residual image. This reconstructed residual block is then added in box 76 to the reference block 81 to generate a reconstructed image block. Generally the reconstructed image is loop filtered in box 78 to reduce blocking artifacts caused by the quantization and transform process. The filtered image is then buffered in box 80 to form reference frames. The frame buffering in box 80 uses the reconstructed reference frames for motion estimation and compensation. The

reference block 81 is compared to the input video block in comparator 64. An encoded image is output at node 71 from the encoding section and is then either stored or transmitted.

Please replace the paragraph beginning on page 11, line 4 with the following:

It is then determined whether the residual coefficients for the two adjacent blocks are similar. If there is no significant difference between the image residuals of the adjacent blocks, for example, the two blocks j and k have the same ~~of~~ or similar D.C. component (dc(j) __dc(k)), then the deblock filtering process in box 104 is skipped. Skip mode filtering then moves to the next interblock boundary in box 106 and conducts the next comparison in decision box 102. Skip mode filtering can be performed for both horizontally adjacent blocks and vertically adjacent blocks.

Please replace the paragraph beginning on page 11, line 16 with the following:

The skip mode filtering scheme can be applied to spatially subsampled chrominance channels. For example in a case with 4:2:0 color format sequences, skip mode filtering for block boundaries may only rely on the equality of motion vectors and D.C. components for the luminance component of the image. If the motion vectors and the D.C. components are the same, deblock filtering is skipped for both the luminance and chrominance components of the adjacent image blocks. In another embodiment, the motion vectors and the D.C. components are considered separately for each luminance and chrominance component of the adjacent blocks. In this case, a luminance or chrominance component for adjacent blocks may be deblock filtered while the other luminance or chrominance components for the same adjacent blocks are sometimes not deblock filtered.

Please replace the paragraph beginning on page 12, line 12 with the following:

In contrast to the block by block manner of filtering, the present inventors came to the realization that filtering determinations should be made in an edge by edge manner together with other information. The other information, may include for example, ~~information related to~~ intra-block encoding of blocks, ~~information related to~~ motion estimation of blocks with residual information, ~~information related to~~ motion estimation of blocks without residual information, and ~~information related to~~ motion estimation of blocks without residuals having sufficient differences~~, information related to reference frames, and information related to motion vectors of adjacent blocks~~. One, two, three, or four of these information characteristics may be used to improved filtering abilities in an edge by edge manner. Based upon different sets of characteristics, the filtering may be modified, as desired.

Please replace the paragraph beginning on page 14, line 17 with the following:

The value of the boundary strength, namely, one, two, and three, is used to control the pixel value adaptation range in the loop filter. If desired, each different boundary strength may be the basis of a different filtering. For example, in some embodiments, three kinds of filters may be used wherein a first filter is used when Bs=1, a second filter is used when Bs=2 and a third filter is used when Bs=3. It is to be understood that ~~non-filtering may be performed by~~ minimal filtering in comparison to other filtering which results in a more significant difference <u>may be performed even when there is no filtering (corresponding to Bs=0)</u>. In the example shown in FIG. 8 the larger the value for Bs the greater the filtering. The filtering may be performed by any suitable technique, such as methods described in Joint Committee Draft

(CD) of the Joint Video Team (JVT) of ISO/IEC MPEG and ITU-T VCEG (JVT-C167) or other known methods for filtering image artifacts.

Please replace the paragraph beginning on page 16, line 14 with the following:

In some embodiments of the present invention, as illustrated in Figure 10~~,~~ image data 1002 may be encoded and the encoded image data may then be stored on storage media 1006~~. The basic procedure of image data encoding apparatus 1004, storage media 1006,~~ and image data decoding apparatus 1008 is the same as in Figure 9. In Figure 10, Bs data encoding portion 1012 receives the value of the boundary strength Bs for each block boundary and encoded by any data encoding method which includes DPCM, multi-value run-length coding, transform coding with loss-less feature and so on. The boundary strength Bs may be generated as described in Figure 8. The encoded boundary strength may then be stored on storage media 1006. In one example, the encoded boundary strength may be stored separately from the encoded image data. In other example, the encoded boundary strength and the encoded image data may be multiplexed before storing on the storage media 1006.

Please replace the paragraph beginning on page 17, line 11 with the following:

In some embodiments of the present invention, as illustrated in Figure 11, image data 1102 may be input to an image data encoding apparatus 1104 which includes the adaptive filtering portion as described above for some embodiments of the present invention. Output from the image data encoding apparatus 1104 is an encoded image data and may then be sent over a network, such as a LAN, WAN or the Internet 1106. The encoded image data may be received and decoded by an image ~~data~~ decoding apparatus 1108 which also communicates with

network 1106. The image data decoding apparatus 1108 includes the adaptive filtering portion as described above for some embodiments of the present invention. The decoded image data may be provided for output decoded image data 1110 to a display or other device.

Please replace the paragraph beginning on page 17, line 21 with the following:

In some embodiments of the present invention, as illustrated in Figure 12, image data 1202 may be encoded and the encoded image data may then be sent over a network, such as a LAN, WAN or the Internet 1206. The basic procedure of image data encoding apparatus 1204 and image data decoding apparatus 1208 is the same as Figure 11. In Figure 12, Bs data encoding portion 1212 receives the value of the boundary strength Bs for each block and encoded by any ~~date~~ data encoding method which includes DPCM, multi-value run-length coding, transform coding with loss-less features and so on. The boundary strength Bs may be generated as described in Figure 8. The encoded boundary strength may then be sent over the network 1206. In one example, the encoded boundary strength may be sent separately from the encoded image data. In other examples, the encoded boundary strength and the encoded image data may be multiplexed before sending over the network 1206.

Please replace the paragraph beginning on page 18, line 11 with the following:

The encoded boundary strength may be received from the network 1206 and decoded by Bs data decoding portion 1214 to input the decoded boundary strength to image data decoding apparatus 1208~~. When decoding boundary strength is utilized in image data decoding apparatus 1208~~ to perform the adaptive filtering of the present invention, it may not be necessary to repeat the process described in Figure 8 to generate boundary strength and this may ~~same~~ save the processing power for the adaptive filtering.